

Description

[GOLF CLUB HEAD AND METHOD OF PRODUCING THE SAME]

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Chinese Patent Application No.03140244.5, filed August 22, 2003.

BACKGROUND OF INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a golf club head. More specifically, the present invention relates to a golf club head with a transparent polymer material and a method of producing the same.

[0004] 2. Description of the Related Art

[0005] A golf club can be a putter, an iron and a wood which has different head in the shape and weight. A putter head is generally made from metals. There is also a putter head substantially made from thermosetting polymer, as is disclosed in U.S. Pat. No. 6,217,459. In the history there were

putters with faces composed of gutta percha. A iron head is typically made from metals. A wood head was originally made from woods, and now for durability woods are substituted by metals and polymer materials.

- [0006] Various kinds of putter heads with polymer insert are known from the prior art. One such example is disclosed in U.S. Pat. No. 5,5757,472 to Magerman et al. This patent provides a putter head with a recess into which is poured or inserted a resinous material which cures and is subsequently milled to produce the putter.
- [0007] Another example is disclosed in OLE_LINK1 U.S. Pat. No. 5,524,331 to Pond. A graphite-epoxy composite insert is cast within a recess in the metal faceplate of the club head of the 5,524,331 patent. Such an insert is directed at displacing the weight away from the center and increasing the moment of inertia.
- [0008] Another example is found in U.S. Pat. No. 5,485,997 to Schmidt et al. This patent provides a putter head with a faceplate composed of a non-metallic material such as an elastomer, wherein the putter has enlarged sweet spot and improved peripheral weighting.
- [0010] Another example is disclosed in U.S. Pat. No. 5,931,743 to Baker et al. A putter with an insert composed of a thermoplastic

polyurethane is provided in this patent.

[0009] Another example is disclosed in U.S. Pat. No. 5,458,332 to Fisher and a set of golf putters is provided, each having an insert composed of polyurethane with a hardness ranging from about 70 Shore A to about 80 Shore D.

[0010] Another example is that in U.S. Pat. No. 6,478,690 to Helmsteter et al., in which a club head comprising a sole, a crown, a toe section, a heel section, a rear section and a front face having a recess is disclosed. An insert is disposed within the recess. The insert is composed of a polymer material and has a Shore D hardness in the range of 42 to 55 and a Bayshore rebound in the range of 55 to 70. The polymer material used in the insert can be a thermosetting polyurethane formed from a p-phenylene di-isocyanate prepolymer and a curing agent, a toluene di-isocyanate (TDI) based polyurethane prepolymer and a curing agent, or a TDI-based polyurethane prepolymer, a PPDI-based polyurethane prepolymer and a curing agent. The club head also has a weight body composed of a tungsten alloy and an isolation layer which is composed of a polymer material and disposed between the weight body and the main body. The isolation layer is preferably composed of a thermoplastic polyurethane. The thickness of

the isolation layer 52 varies from 0.020 inch to 0.100 inch.

- [0011] Another example is disclosed in U.S. Pat. No. 6,217,459 which describes a putter head made from a polymer material as a one-piece unit. A golf ball-striking faceplate is mounted to the putter head. The polymer material used in this patent can be a thermosetting epoxy resin, polyester resin, acrylonitrile butadiene styrene, acetal, polycarbonate, polyvinyl chloride, polysulfone resin, fiberglass or vinyl esters, preferably a thermosetting epoxy resin. The above polymer material may contain aligned or randomly-oriented fibers for suitable use.
- [0012] Another example is disclosed in U.S. Pat. No. 5,135,227 to Okumoto et al. which describes a wood head comprising a hollow metal head body and a core material filling the inside of the metal head body, wherein the core material is an aggregate prepared by fusing expandable beads comprising a microcapsule of a synthetic polymer and an expanding gas enclosed therein to each other through the expansion of the gas and has a bulk specific gravity of 0.05 to 0.15 g/cm³.
- [0013] Another example is disclosed in U.S. Pat. No. 5,743,813 to Chen et al. which describes a wood head comprising a

hollow body and a face consisting of a first (outer) layer made of stainless steel, a second (intermediate) layer made of non-metal elastic and shock-absorbing material, and a third (inner) layer made of stainless steel.

[0014] U.S. Pat. No. 6,435,980 discloses a wood head composed of a composite material with a textured coating on its striking plate for better durability. The textured coating can be made from a plurality of polymer resin particles, a carrier and a coupling agent. The plurality of polymer resin particles are present in an amount ranging from 5% to 30% of the volume of the texture coating. The textured coating has a thickness of 0.0005 inch to 0.003 inch.

[0015] Yet another example is in Chinese Patent No. CN 93211978.6 which discloses a composite golf club head with a protection plate on the face. There is a recess in the center of the faceplate, within which there is a fibre reinforced resinous striking layer.

[0016] Still another example is disclosed in Chinese Patent No. CN 93202806.3 in which a composite golf club head is provided comprising an outer shell made from a metal material as a one-piece unit, an inner shell attached to the inner wall of the outer shell and made from carbon fibre reinforced epoxy resin, a plate and a front wall for form-

ing the faceplate of the club head. The front wall is also composed of carbon fibre reinforced epoxy resin.

[0017] Although various golf club heads with polymer inserts or comprising composite materials containing polymers have been disclosed, polymer inserts provided in the prior art are generally composed of thermosetting polyurethane, polyester resin or epoxy resin. The production of such inserts requires chemical reactions in the mold such as curing reaction and coupling reaction and therefore it is difficult to control the production process. Further, an insert produced in the prior art is unsatisfactory in luster and transparency, and thus does not possess an aesthetically pleasing appearance.

SUMMARY OF INVENTION

[0018] One aspect of the present invention is a golf club head having an polymer insert composed of thermoplastic transparent polymer material or resin. The golf club head has a recess with the polymer insert located therein. The polymer insert is composed of a thermoplastic transparent polymer material and has a thickness from 2 to 25 mm and a gloss and lustrous surface. The recess can be formed in the striking faceplate of a putter, the rear section of an iron or the crown of a wood. A pattern or a logo

can be placed under the polymer insert. The thermoplastic transparent polymer material can be selected from the group consisting of polymethacrylate (PMA), polyacrylate (PA), polycarbonate, polyethylene terephthalate (PET), transparent poly- propylene, transparentpolyethylene, transparent polyvinyl chloride, transparent nylon, thermoplastic polyurethane, and the mixtures thereof.

- [0019] Preferably, the thermoplastic transparent polymer material is selected from the group consisting of polymethacrylate, polyacrylate, polyethylene terephthalate, thermoplastic polyurethane and the mixtures thereof. More preferably, the thermoplastic transparent material is organic glass, i.e. polymethyl methacrylate (PMMA).
- [0020] Another aspect of the present invention is a method of producing a golf club head with a polymer insert. The method comprises the steps:
 - [0021] (1) producing a coarse area or coarse areas within the recess surface/surfaces of a golf club head by grinding or abrasion,
 - [0022] (2) selecting a thermoplastic transparent polymer material and applying heat on it until it melts into fluid,
 - [0023] (3) pouring the polymer fluid obtained in step (2) into the abraded recess obtained in step (1),

- [0024] (4) subsequently making the polymer fluid of step (3) dried and hardened,
- [0025] (5) abrading the completely dried polymer obtained in step (5), and
- [0026] (6) slowly polishing the abraded polymer obtained in step (5) until a completely planar and transparent polymer insert is obtained.
- [0027] Preferably, a pattern or a logo can be placed into the abraded recess obtained in the above step (1) before the above step (3).

BRIEF DESCRIPTION OF DRAWINGS

- [0028] Fig. 1 is a schematic view of a putter head with a abraded recess in its faceplate.
- [0029] Fig. 2 is a schematic view of the putter head of Fig. 1 with a logo placed within the abraded recess.
- [0030] Fig. 3 is a schematicview of the putter head of Fig. 2 with a transparent polymer insert in the recess.
- [0031] Fig. 4 is a schematic view of an iron head with a abraded recess in its backside.
- [0032] Fig. 5 is a schematic view of the iron head of Fig. 4 with a logo placed within the abraded recess.
- [0033] Fig. 6 is a schematic view of the iron head of Fig. 5with a transparent polymer insert in the recess.

- [0034] Fig. 7 is a schematic view of a wood head with a abraded recess in its crown.
- [0035] Fig. 8 is a schematic view of the wood head of Fig. 7 with a logo placed within the abraded recess.
- [0036] Fig. 9 is a schematic view of the wood head of Fig. 8 with a transparent polymer insert in the recess.

DETAILED DESCRIPTION

- [0037] The present invention is directed at golf club heads with pleasant appearance. Such an aim can be achieved by placing a transparent polymer insert in the recess of a club head.
- [0038] The polymer insert of the present invention has a gloss and lustrous surface and is completely transparent. A pattern or logo within or under the polymer insert is highly visible from its exterior. The polymer insert is also capable of adjusting the location of the center of gravity and thereby providing easy strikes. In addition, the polymer insert is also capable of dampening vibration. The pattern or logo can be made from polyethylene, polyurethane, aluminum alloy, or the like.
- [0039] If the golf club head is a putter head, the polymer insert generally has a thickness of 2 to 12 mm, preferably 4 to 10 mm.

- [0040] If the golf club head is an iron head, the polymer insert generally has a thickness of 4 to 22 mm, preferably 10 to 18 mm.
- [0041] If the golf club head is a wood head, the polymer insert generally has a thickness of 10 to 25 mm, preferably 15 to 20 mm.
- [0042] The present invention is also directed at a method of making golf club heads with pleasant appearance. According to the present invention, a transparent polymer insert can be placed in the recess of a club head by using a method comprising substantially 6 steps mentioned above. Such a method does not involve any curing reaction coupling reaction and thus it can be easily realized.
- [0043] The club head obtained after step (6) of the above method can be put into an oven and baked at a temperature of about 60 to 80°C for several hours. Specific baking temperature and baking time is dependent upon the type of polymer material selected. Furthermore, a coating layer, e.g. a layer produced by applying Polisher of 3M company, can be applied on the polymer insert obtained in step (6) to enhance the glossiness and luster of the polymer insert and protect polymer surface from scratches and other damages.

- [0044] According to the present invention, the course surface within the recess produced by abrasion in step (1) can increase the adhesion of the recess surface with the polymer insert disposed, and thereby increase the life span of the club head. It is, therefore, not necessary to use an adhesive.
- [0045] If there is not a recess in the club head, a recess should first be formed before step (1).
- [0046] If a pattern or log is placed into the abraded recess before step (3) it shall not take up the entire abraded surface of the recess, preferably not take up the entire bottom surface because the contacting area of the recess with polymer material will affect their adhesion.
- [0047] Generally, the temperature for heating and melting the polymer material used in step (2) is in the range between 80 to 150°C. Specific temperature is dependent upon the polymer material selected, the speed of processing, etc.
- [0048] The drying process in step (4) is preferably vacuum drying and lasts several hours to tens of hours.
- [0049] During the abrading process in step (5), a special solvent, such as an organic solvent which can solve the selected polymer material in some extent, can be added (e.g. sprayed) onto the polymer so as to avoid quality decrease-

ing, such as developing of cracks on the surface, which is caused by the rise of temperature during the abrading process.

- [0050] The surface obtained in step (5) generally has a foggy appearance. Therefore, a further polishing step, i.e. step (6), is needed. This polishing process may utilize another type of solvent, such as an inorganic solvent. In addition, the solvent can be introduced with pressure.
- [0051] The method of the present invention is easy to monitor and control. Products of superior quality are thereby produced at lower costs.
- [0052] Referring to *FIGS. 1-3*, in a preferred embodiment there is a recess 12 in the striking faceplate 11 of a putter head 10. The bottom surface 13 and/or other inner surfaces of the recess 12 are abraded to form a coarse area or coarse areas.
- [0053] An aluminum logo 14 is then placed into the abraded recess 12. Organic glass (PMMA) is heated until it melts into fluid, which is subsequently poured into the abraded recess 12. The PMMA fluid poured into the abraded recess 12 should be controlled in an amount that after curing the solid PMMA extends slightly beyond or in the same level with the edges of the abraded recess 12. The PMMA fluid

in the recess 12 is made dried and hardened in about 15 hours in a vacuum state. With the existence of acetone, the completely dried PMMA obtained is abraded by a 180# sand paper or sandcloth. Subsequently, the PMMA is polished by a sandcloth with smaller particles in the existence of high pressure water until a polymer insert 15 with completely flat and transparent surface is obtained.

[0054] Referring to *FIGS. 4–6*, in a preferred embodiment there is a recess 22 in a backside 21 of an iron head 20. The bottom surface 23 and/or other inner surfaces of the recess 22 are abraded to form a coarse area or coarse areas.

[0055] An aluminum logo 24 is then placed into the abraded recess 22. Organic glass (PMMA) is heated until it melts into fluid, which is subsequently poured into the abraded recess 22. The PMMA fluid poured into the abraded recess 22 should be controlled in an amount that after curing the solid PMMA extends slightly beyond or in the same level with the edges of the abraded recess 22. The PMMA fluid in the recess 22 is made dried and hardened in about 20 hours in a vacuum state. With the existence of acetone, the completely dried PMMA obtained is abraded by a 180# sand paper or sandcloth. Subsequently, the PMMA is polished by a sandcloth with smaller particles in the exis-

tence of high pressure water until a polymer insert 25 with completely flat and transparent surface is obtained.

- [0056] Referring to *FIGS. 7–9*, in a preferred embodiment a recess 32 is formed first in the crown 31 of a wood head 30. The bottom surface 33 and/or other inner surfaces of the recess 32 are abraded to form a coarse area or coarse areas.
- [0057] An aluminum logo 34 is then placed into the abraded recess 32. Organic glass (PMMA) is heated until it melts into fluid, which is subsequently poured into the abraded recess 32. The PMMA fluid poured into the abraded recess 32 should be controlled in an amount that after curing the solid PMMA extends slightly beyond or in the same level with the edges of the abraded recess 32. The PMMA fluid in the recess 32 is made dried and hardened in about 25 hours in a vacuum state. With the existence of acetone, the completely dried PMMA obtained is abraded by a 180# sand paper or sandcloth. Subsequently, the PMMA is polished by a sandcloth with smaller particles in the existence of high pressure water until a polymer insert 35 with completely flat and transparent surface is obtained.
- [0058] It will be understood that the perferred embodiments of the invention set forth above are shown by way of illustration and not as limitations of the invention. Other modifi-

cation and variation can be made to the disclosed embodiments without departing from the spirit and scope of the appended claims and equivalents thereof.